Pressurized medium consumer device

The invention relates to a pressurized-fluid-consuming device according to claim 1.

Such pressurized-fluid-consuming devices are known in automotive engineering in the form, for example, of service-brake systems, trailer-brake systems, parking-brake systems or air-suspension systems. Such pressurized-fluid-consuming devices draw the needed pressurized fluid from one or frequently also from a plurality of pressurized-fluid storage reservoirs. To fill the pressurized-fluid storage reservoir with the pressurized fluid, there is usually provided a pressurized-fluid supply device. When compressed air, for example, is used as the pressurized fluid, the pressurized-fluid supply device is provided in known manner with a compressor, an air dryer, a pressure regulator and, for separation of individual compressed air circuits, a multi-circuit protective valve. Such a compressed air supply device can also be equipped with an electronic controller, as known, for example, from German Patent 10004091 C2. The electronic controller then takes over the functions of the pressure regulator and of the multi-circuit protective valve of conventional type in conjunction with suitable sensors and actuators. In other words, the electronic controller then contains a multi-circuit protective function.

When the aforesaid pressurized-fluid-consuming devices are used in a vehicle, safety reasons dictate that any pressurized-fluid-consuming devices whose availability

influences operation of the vehicle only slightly or not at all in a manner critical to safety cannot affect the function of other pressurized-fluid-consuming devices whose availability influences operation of the vehicle in a manner critical to safety, as they might do, for example, through rapid pressurized-fluid consumption. The brake system of a vehicle represents an example of a pressurized-fluid-consuming device with consequences that are particularly critical to safety if its availability is limited, and an air-suspension system represents an example of a pressurized-fluid-consuming device with consequences that are only slightly critical to safety.

In the case of vehicles with a compressed air brake system, EU Directive 98/12 in particular is to be complied with in this connection. In particular, in order to satisfy Paragraph 2.2.1.16 of Appendix I of the aforesaid Directive, it is known that certain groups of compressed air-consuming devices must each be provided with its own compressed air storage reservoir. In the normal case, for example, the brake system uses one compressed air storage reservoir for the front-axle brake circuit and a separate compressed air storage reservoir for the rear-axle brake circuit. In addition, separate compressed air storage reservoirs are provided for each of the other compressed air consumers, such as the aforesaid air-suspension system. The intention is to ensure hereby that the secondary consumers mentioned in EU Directive 98/12, or in other words those consumers such as the air-suspension system that do not belong to the service-brake system of the vehicle, do not undesirably reduce the compressed air reserves stored in the compressed air storage reservoirs of the service-brake system to such an extent by their operation that adequate braking capacity of the vehicle is jeopardized. The known approach of providing separate compressed air storage

reservoirs for a plurality of compressed air circuits is associated with high costs and great complexity during installation of the compressed air system in a vehicle.

The object of the invention is therefore to provide a pressurized-fluid-consuming device, whose use permits the design of a less complex and less expensive pressurized-fluid system.

This object is achieved by the invention specified in claim 1. Improvements and advantageous configurations of the invention are specified in the dependent claims.

The invention has the advantage that, by use of the inventive pressurized-fluid-consuming device as a secondary consumer within the foregoing meaning, it is possible to dispense with a separate pressurized-fluid storage reservoir for this secondary consumer. To supply the pressurized-fluid-consuming device with pressurized fluid, it can then be simply connected, via a multi-circuit protective function used for decoupling the individual pressurized-fluid circuits in the manner of a multi-circuit protective valve of conventional type, to other pressurized-fluid storage reservoirs, such as the pressurized-fluid storage reservoirs of the service-brake system, which must be present in any case, for example to satisfy EU Directive 98/12. Hereby the costs for the eliminated pressurized-fluid storage reservoir as well as for corresponding pressurized-fluid lines needed for connection thereof can be saved. In addition, costs and time for installation of the pressurized-fluid system can be saved. A further advantage is that the regulations of EU Directive 98/12 are then satisfied. In this connection, the inventive pressurized-fluid-consuming device automatically ensures compliance with the

regulations, without the need to take further provisions of these regulations into consideration in designing the pressurized-fluid system of the vehicle. A further advantage is that overflow valves that may have been present together with such secondary consumers can be dispensed with.

In an advantageous configuration of the invention, several physical variables, such as the pressure in the pressurized-fluid storage reservoir or the quantity of air contained therein or the mass of air contained therein or the energy stored therein can be used as the value of state. This has the advantage that a physical variable that may have already been determined by means of sensors for other purposes can be used by the inventive pressurized-fluid-consuming device. The use of pressure as the value of state has the advantage that a pressure sensor can be used for sensing, an approach which is a relatively inexpensive.

The invention will be explained in more detail hereinafter and further advantages will be pointed out on the basis of a practical example and a drawing, wherein:

Fig. 1 shows a pressurized-fluid system with inventive pressurized-fluid-consuming devices disposed therein.

In Fig. 1, pressurized-fluid lines are represented by solid lines and electrical lines by broken lines. It will be assumed hereinafter that the pressurized-fluid system according to Fig. 1 is used in a vehicle.

A pressurized-fluid supply device (1) is provided with pressurized-fluid discharge ports (2, 3, 4), which via pressurized-fluid lines are in communication with pressurized-fluid storage reservoirs (8, 9, 10). Pressurized-fluid-consuming devices (11, 12, 13) are in communication with pressurized-fluid storage reservoirs (8, 9, 10) via pressurized-fluid lines. The pressurized-fluid-consuming devices (11, 12, 13) are, for example, service-brake circuit (11) of the front axle, service-brake circuit (12) of the rear axle and a brake circuit (13) for a trailer.

Pressurized-fluid supply device (1) is provided with a multi-circuit protective function, which is used for decoupling the aforesaid pressurized-fluid circuits and which satisfies the function of a known multi-circuit protective valve. Such a multi-circuit protective function as well as a specific configuration containing pneumatic valves is known, for example, from German Patent 19622095 A1.

Pressurized-fluid supply device (1) is provided with further pressurized-fluid discharge ports (20, 21), to which there are respectively connected, via respective pressurized-fluid lines, a first inventive pressurized-fluid-consuming device (14) and a second inventive pressurized-fluid-consuming device (15). First inventive pressurized-fluid-consuming device (14) can be placed in communication with pressurized-fluid storage reservoir (9) via the multi-circuit protective function, and second inventive pressurized-fluid-consuming device (15) can be placed in communication with pressurized-fluid storage reservoir (8) via the multi-circuit protective function. Pressurized-fluid-consuming device (14) or (15) can be designed, for example, as a level-control system for a motor vehicle.

In an advantageous configuration of the invention, pressurized-fluid supply device (1) and if necessary pressurized-fluid-consuming devices (11, 12, 13) are each provided with an electronic controller as well as with a port for a data bus. According to an advantageous configuration, the data-bus ports are connected to one another via a data bus (16), such as a CAN bus (CAN = controller area network).

In an advantageous configuration of the invention, pressurized-fluid-consuming devices (14, 15) are each equipped with an electronic controller and with a port (18, 19) for the data bus. Devices (1, 11, 12, 13, 14, 15) can exchange data with one another over data bus (16).

Pressurized-fluid supply device (1) is connected via electrical lines to pressure sensors (5, 6, 7), each of which is in pneumatic communication with pressurized-fluid storage reservoirs (8, 9, 10) and senses the respective pressure in pressurized-fluid storage reservoirs (8, 9, 10) and transmits it as a pressure signal to pressurized-fluid supply device (1). Pressure sensors (5, 6, 7) can also be integrated into pressurized-fluid supply device (1). Pressurized-fluid supply device (1) transmits the pressure signals of pressure sensors (5, 6, 7) over data bus (16).

It is also advantageous to connect pressure sensors (5, 6, 7) via the electrical lines to another device in the vehicle, such as an electronics unit of the instrument panel. In compressed air-braked motor vehicles, it is customary to mount indicator instruments in the instrument panel for indication of the pressure present in pressurized-fluid storage reservoirs (8, 9, 10), so as to inform the operator of the motor vehicle about the current

pressure values. For this purpose the instrument panel or the electronics unit of the instrument panel used to control indicator functions of the instrument panel is connected to the pressure sensors. Advantageously, the electronics unit of the instrument panel is designed such that it is also connected to data bus (16) and that it transmits the pressure signals of pressure sensors (5, 6, 7) over data bus (16) to pressurized-fluid supply device (1) and if necessary to other receiving devices.

According to an advantageous configuration of the invention, pressurized-fluid-consuming devices (14, 15) are capable of receiving pressure signals from data bus (16).

According to an advantageous configuration of the invention, pressurized-fluid-consuming device (1) or the electronics unit of the instrument panel transmits the pressure values determined by pressure sensors (5, 6, 7) onto data bus (16) in the form of pressure signals of the respective pressurized-fluid storage reservoir (8, 9, 10). Pressurized-fluid-consuming devices (14, 15) receive and evaluate these pressure signals. In pressurized-fluid-consuming devices (14, 15) there are programmed respective predetermined minimum pressure values, with which they compare the respective received pressure signals. For this purpose microprocessors that execute a resident program are provided in the electronic controller of pressurized-fluid-consuming devices (14, 15). During execution of the program, the aforesaid comparison between the predetermined minimum pressure value and the received pressure signal is performed.

If it is found during this process that the pressure value indicated by the pressure signal does not reach the predetermined minimum pressure value and thus is below that value, the electronic controller of pressurized-fluid-consuming devices (14, 15) prevents pressurized-fluid consuming devices (14, 15) from drawing any pressurized fluid from respective pressurized-fluid storage reservoir (8, 9). Only when the predetermined minimum pressure value is reached or exceeded does the electronic controller permit the drawing of pressurized fluid on demand. The other functions of pressurized-fluid-consuming devices (14, 15) that can be performed even without drawing of pressurized fluid are performed even if the pressures are below the minimum value.

Pressurized-fluid-consuming device (11) is also connected via an electrical line to a speed sensor (17). The travel speed of the vehicle can be determined from the signal of the speed sensor. Pressurized-fluid-consuming device (11) receives the signal of speed sensor (17) and transmits a speed signal corresponding to this value of speed onto data bus (16). Pressurized-fluid-consuming devices (14, 15) receive and evaluate the speed signal from data bus (16). If as a result there is detected a vehicle speed slower than a predetermined minimum value of speed, for example close to vehicle standstill, pressurized-fluid devices (14, 15) then draw pressurized-fluid from pressurized-fluid storage reservoirs (8, 9) on demand even if the pressure is below the predetermined minimum value.